DOCUMENT RESUME

ED 411 159 SE 060 567

TITLE	Mathematics 33. Grade 12 Diploma Examination.
INSTITUTION	Alberta Dept. of Education, Edmonton. Student Evaluation Branch.
PUB DATE	1997-06-00
NOTE	56p.
AVAILABLE FROM	Alberta Education, Student Evaluation Branch, 11160 Jasper Avenue, Edmonton, Alberta T5K 0L2, Canada.
PUB TYPE	Tests/Questionnaires (160)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Academic Achievement; Foreign Countries; Grade 12; *Graduation Requirements; High Schools; *Mathematics Tests; *Standardized Tests; Student Evaluation; Testing Programs
IDENTIFIERS	*Alberta Grade Twelve Diploma Examinations

ABSTRACT

This document is the Grade 12 diploma examination in mathematics at Level 33 from the Office of the Ministry of Education in Alberta, Canada. The two-and-a-half hour test is a closed-book examination consisting of 37 multiple choice and 12 numerical response questions of equal value worth 70% of the examination, and four written response questions worth a total of 30% of the examination. (DDR)

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ED 411 159

June 1997

Mathematics 33

Grade 12 Diploma Examination

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EDUCATION

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June 1997

Mathematics 33

Grade 12 Diploma Examination

Description

Time: 2.5 h. You may take an additional 0.5 h to complete the examination.

This is a **closed-book** examination consisting of

- 37 multiple-choice and 12 numerical-response questions of equal value, worth 70% of the examination
- 4 written-response questions, worth a total of 21 marks or 30% of the examination

Total possible marks: 70

This examination contains sets of related questions

A set of questions may contain multiple-choice and/or numerical-response and/or written-response questions.

A mathematics data booklet is provided for your reference.

The perforated pages at the back of this booklet may be torn out and used for your rough work. No marks will be given for work done on the tear-out pages.

Instructions

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- You are expected to provide your own scientific calculator.
- Use only an HB pencil for the machine-scored answer sheet.
- If you wish to change an answer, erase **all** traces of your first answer.
- Do not fold the answer sheet.
- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.

Multiple Choice

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

Example

This examination is for the subject of

A. mathematics
B. chemistry
C. biology
D. physics

Answer Sheet

● Ⓑ Ⓒ Ⓓ

Numerical Response

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

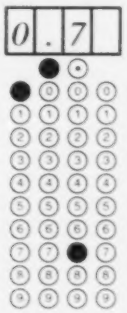
Example 1

The value of tan 35° to the nearest tenth is _____.

(Record your answer on the answer sheet.)

Calculator value: 0.7002075
Value to be recorded: 0.7

Record 0.7 on the answer sheet →

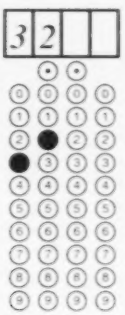


Example 2

The constant term in the quadratic function $y = 2x^2 + 7x + 32$ is _____.
(Record your answer on the answer sheet.)

Value to be recorded: 32

Record 32 on the answer sheet ⟶

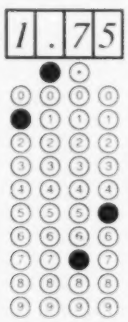


Example 3

If an annual interest rate of 7% is compounded quarterly, then the quarterly rate to the nearest hundredth of a percent is _____%.
(Record your answer on the answer sheet.)

Value to be recorded: 1.75

Record 1.75 on the answer sheet ⟶



Written Response

- Write your answers in the examination booklet as neatly as possible.
- For full marks, your answers must be well organized and address **all** the main points of the question.
- Descriptions and/or explanations of concepts must be correct and reflect pertinent ideas, calculations, and formulas.
- Your answers **should be** presented in a well-organized manner using complete sentences for a written response, and correct units for a numerical response.

TECHNOLOGY

In the seventeenth century, the mathematician René Descartes developed coordinate geometry. He believed that we gain a deeper understanding of relations by representing them graphically. Use the skills you have acquired in interpreting various relations and functions, and their graphs to answer the following questions.

Use the following information to answer the next question.

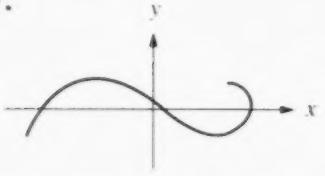
Four relations are shown below, two as sets of ordered pairs and two as graphs.

I. $\{(-3, 4), (-1, 4), (1, -4), (5, 8)\}$

II. $\{(-5, 2), (3, 2), (-1, 4), (1, 5), (1, 6)\}$

III.

IV.



1. Of these four relations, the two that can also be classified as functions are relations

A. I and III

B. I and IV

C. II and III

D. II and IV

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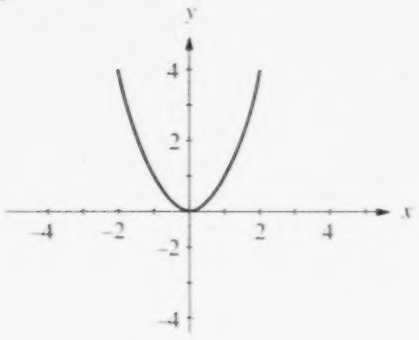
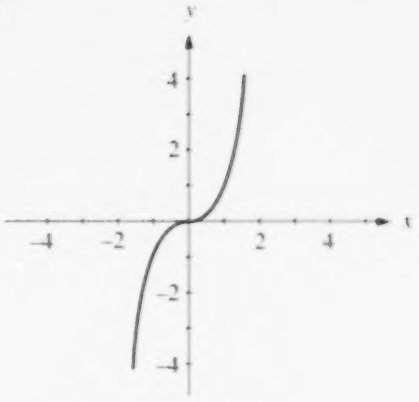
2. Which of the following graphs is a parabola?

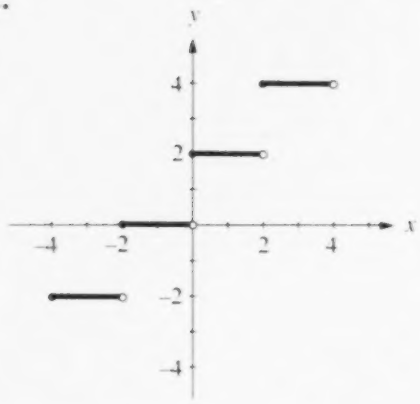
A.



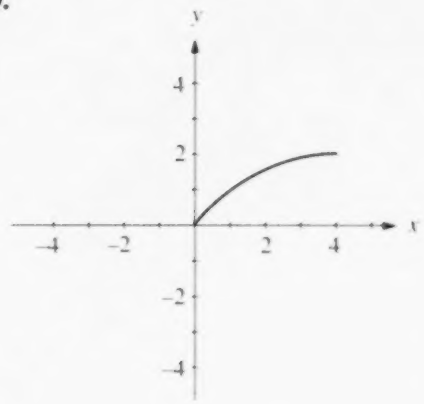
B.



C.



D.



Numerical Response

1. If $f(x) = x^2 - 3x$, then $f(-0.5)$, to the nearest hundredth, is _____.

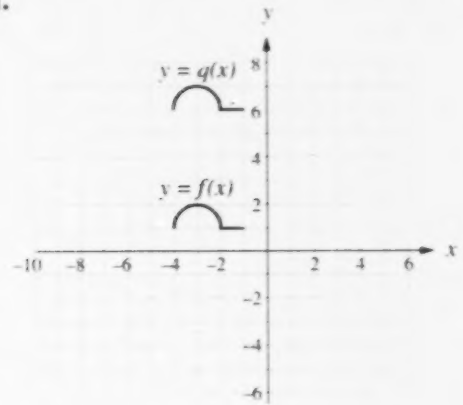
(Record your answer on the answer sheet.)

8

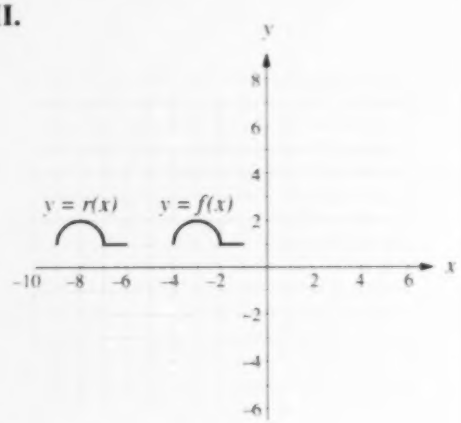
Use the following information to answer the next question.

In each of the four figures below, there are two graphs. One graph is of the function $y = f(x)$, and the other graph is of one of its transformations.

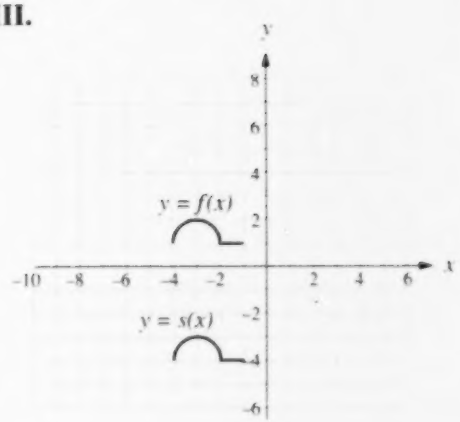
I.



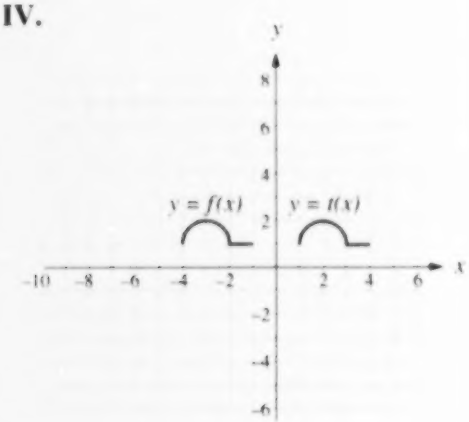
II.



III.



IV.



3. The transformed function that represents $y = f(x - 5)$ is

A. $y = q(x)$

B. $y = r(x)$

C. $y = s(x)$

D. $y = t(x)$

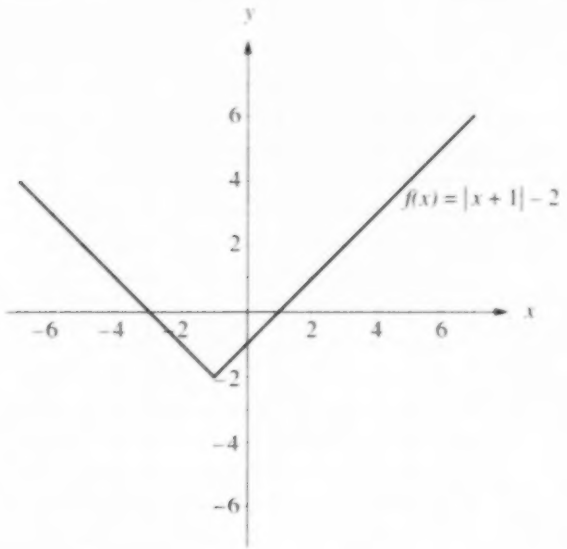
Numerical Response

2. The domain of the function $f(x) = \dfrac{x}{x - 12}$ is the set of all real numbers **except** for the number _____.

(Record your answer on the answer sheet.)

Use the following information to answer the next question.

The graph of the function $f(x) = |x + 1| - 2,\ x \in R,$ is shown below.



4. The range of this function is

A. $y \in R$

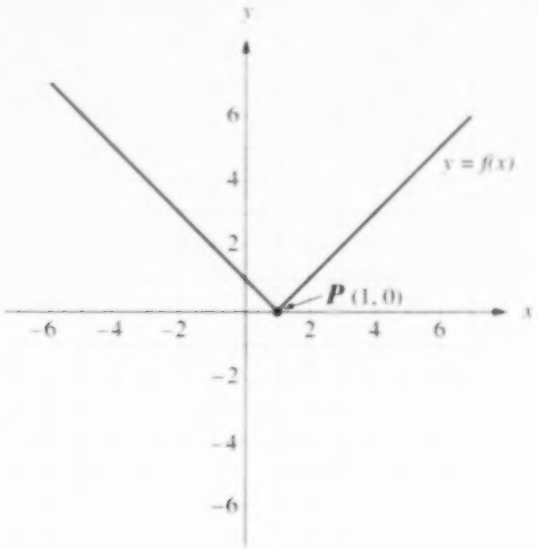
B. $y \leq 6$

C. $y \geq -1$

D. $y \geq -2$

Use the following information to answer the next question.

A technician displayed the graph of the function $y = f(x)$ on a computer screen. The point $P\,(1, 0)$ lies on the graph of the function, as shown below.



When the technician changed the function to $y = f(x - 1.5) + 5.5$ and displayed the graph of the new function, the point corresponding to P on the transformed graph had position (a, b).

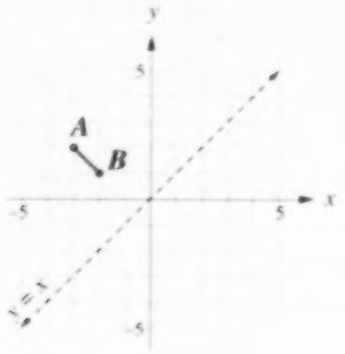
Numerical Response

3. The value of b, to the nearest tenth, is _____.

(Record your answer on the answer sheet.)

Use the following information to answer the next question.

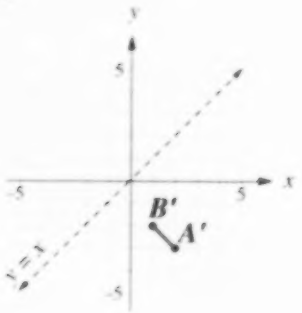
The graph of a function is displayed below. It is the line segment joining the points $A(-3, 2)$ and $B(-2, 1)$.



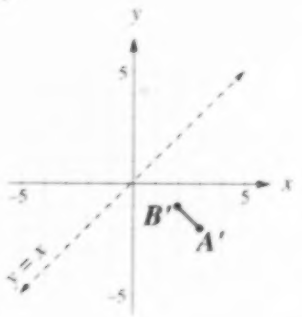
The inverse of this function is needed to solve a problem.

5. Which of the following is the graph of the inverse function?

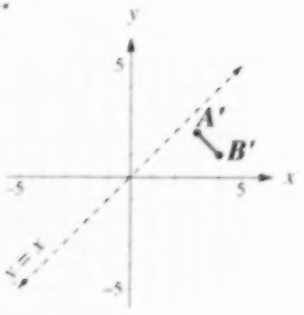
A.



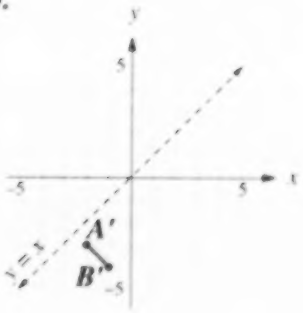
B.



C.



D.



6. The graph of the quadratic function $f(x) = x^2 - 6x + 8$ has the axis of symmetry given by the equation

A. $x = -3$

B. $x = 3$

C. $x = 6$

D. $x = 8$

Use the following information to answer the next question.

The x-intercepts of the graph of the quadratic function $y = ax^2 + bx + c$, $a \neq 0$, are linked to the roots of the quadratic equation $ax^2 + bx + c = 0$.

7. If the quadratic equation $ax^2 + bx + c = 0$ has no real roots, then the graph of $y = ax^2 + bx + c$ has

A. no x-intercepts

B. two positive x-intercepts

C. two negative x-intercepts

D. two equal x-intercepts

Numerical Response

4. The graph of the quadratic function $f(x) = 5x^2 - 7x + 21$ has a y-intercept of _____ .

(Record your answer on the answer sheet.)

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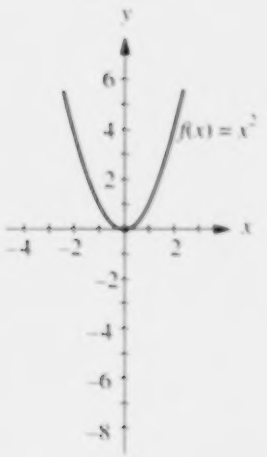
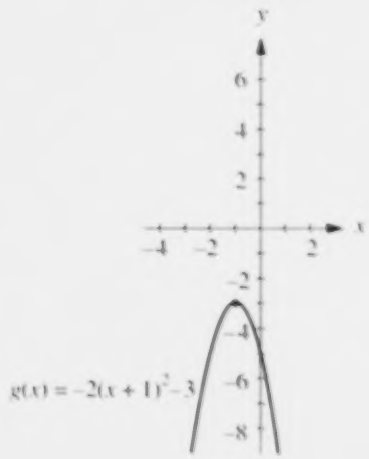
Use the following information to answer the next question.

A graphics designer transformed the graph of the quadratic function $f(x) = x^2$, shown in graph I below, into the graph of the quadratic function $g(x) = -2(x + 1)^2 - 3$, shown in graph II below.

Graph I



Graph II



Written Response — 5 marks

1. **a.** **Refer to the functions** provided to explain **three** major changes that occurred when graph I, which represents $f(x) = x^2$, was transformed into graph II, which represents $g(x) = -2(x + 1)^2 - 3$.

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b. The range for the graph of the function $f(x) = x^2$ is $y \geq 0$. The range for the graph of the function $g(x) = -2(x + 1)^2 - 3$ is $y \leq -3$. Write a quadratic function for a graph with a vertex located in quadrant I that has a range of $y \geq 2$. Begin with $h(x) =$.

- $h(x) =$

- Provide a written explanation why the function you wrote has a range of $y \geq 2$. Your explanation must include more than a sketched graph.

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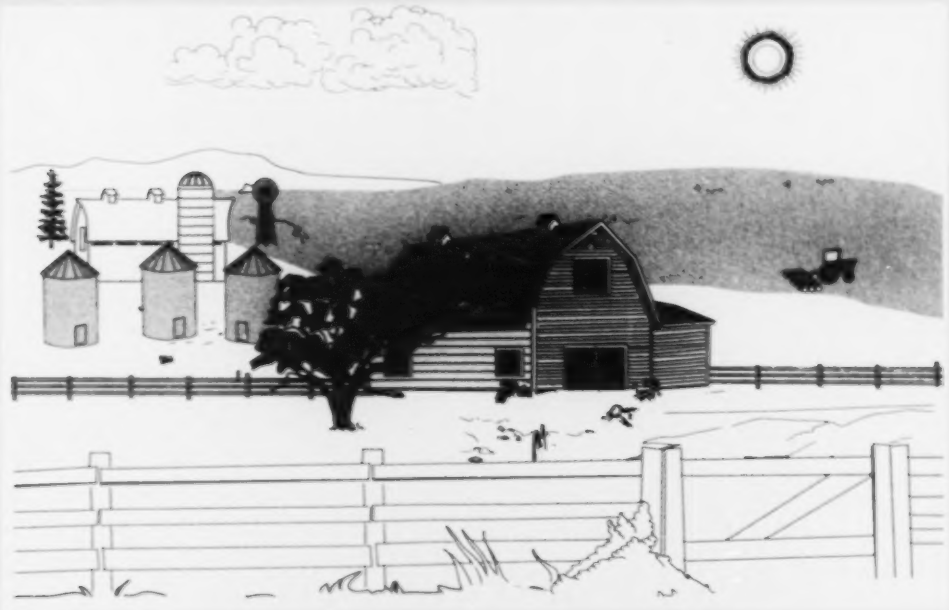
AGRICULTURE

Farmers use mathematics every day to solve problems and make decisions about their farm operations. Use your mathematical background to answer the following questions related to the Applegates' farm.



Use the following information to answer the next question.

The Applegates arranged a $125 000 mortgage for the purchase of additional farmland. The mortgage on the farmland was for 25 years at a rate of 10.5% per annum.

8. The Applegates' monthly payments on this mortgage will be

A. $1 093.75

B. $1 139.20

C. $1 160.41

D. $1 510.42

Use the following information to answer the next question.

One of the Applegates' grain storage bins has the shape of a cylinder. The equation relating the volume V, in cubic metres, to the radius r and height h, in metres, of a cylindrical bin is given by $V = \pi r^2 h$.

9. If the height of the grain storage bin is 16 m and the volume is 1 256 m^3, then the radius of the bin's base, to the nearest metre, is

A. 25 m

B. 10 m

C. 9 m

D. 5 m

Use the following information to answer the next question.

The Applegates devised a financial plan to save $10 000 over a period of two years. The plan consisted of making deposits monthly and collecting interest.

10. To determine how much money they should deposit monthly in order to put this plan in place, the Applegates should refer to the table titled

A. Amount of an Annuity

B. Present Value of an Annuity

C. Monthly Payment on a $1 000 Loan

D. Monthly Payment on a $1 000 Mortgage

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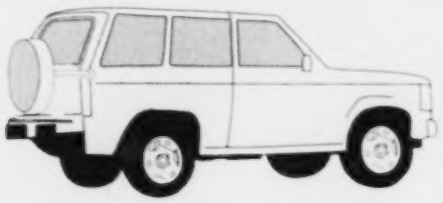
Use the following information to answer the next question.

When the Applegates considered borrowing $20 000 to purchase a vehicle, they obtained options for loans from two different banks. Bank A offered the loan over 6 years at 7% per annum, and Bank B offered the loan over 3 years at $7\frac{1}{2}\%$ per annum.



The Applegates used a loan table to start to calculate the monthly payments on these loans.

Bank A Option
Monthly payment = (20)($17.0490)

Written Response — 5 marks

2. **a.** Complete the following calculations.

Bank A Option

Monthly payment = (20)($17.0490)

= $_____

Bank B Option

Monthly Payment = ( )( )

= $_____

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b. Determine the total amount that would be paid for the $20 000 loan from Bank A and for the $20 000 loan from Bank B.

c. Which loan would you recommend to the Applegates? Explain your reasons.

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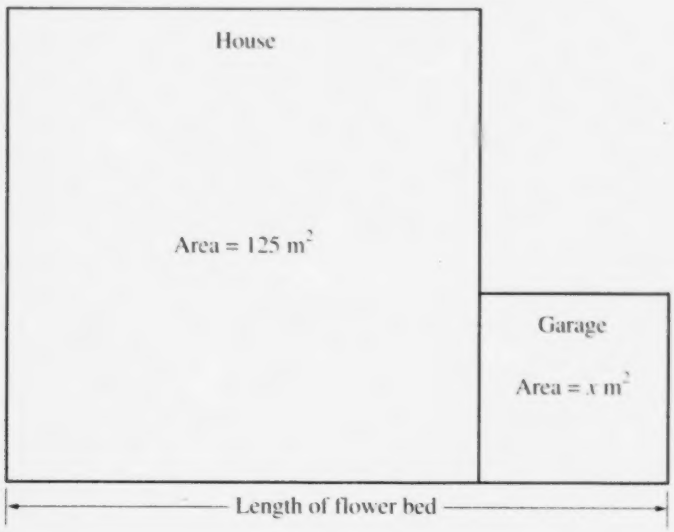
Use the following information to answer the next question.

The Applegates built a flower bed along the length of their house and garage. Both the house and garage have square bases, as shown below.



11. The expression that represents the total length, in metres, of the flower bed is

A. $5\sqrt{5} + \sqrt{x}$

B. $5\sqrt{5} + 2\sqrt{x}$

C. $\sqrt{125} + x^2$

D. $25\sqrt{5} + 2x$

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Use the following information to answer the next question.

Storage instructions for some agricultural products from other countries are provided using Fahrenheit temperatures. For these products, the Applegates convert degrees Fahrenheit into degrees Celsius using the function

$$C = \frac{5}{9}(F - 32),$$

where F represents temperature in degrees Fahrenheit and C represents temperature in degrees Celsius. The Applegates used their home computer to print a graph of this conversion function.

12. The graph of this conversion function is

A. exponential

B. reciprocal

C. quadratic

D. linear

Use the following information to answer the next question.

The Applegates have a small gas appliance that will operate 4 h on a tank of propane. They also have a larger gas appliance that will operate 3 h on the same tank of propane. When both appliances are connected to the tank, the equation $\frac{1}{4}x + \frac{1}{3}x = 1$ can be used to determine the time, x, in hours, that the appliances can be operated simultaneously on one tank of propane.

Numerical Response

5. The value of x, to the nearest **hundredth** hour, is _____h.

(Record your answer on the answer sheet.)

Use the following information to answer the next question.

In order to determine the amount of weed killer to be applied to a barley field, the Applegates estimated the percentage of weed plants in the field. From a random sample of 40 plants in the field, they found 12 weed plants.

13. Based on this sample, the 90% confidence interval for the percentage of weed plants in the whole barley field is between

A. 15% and 50%

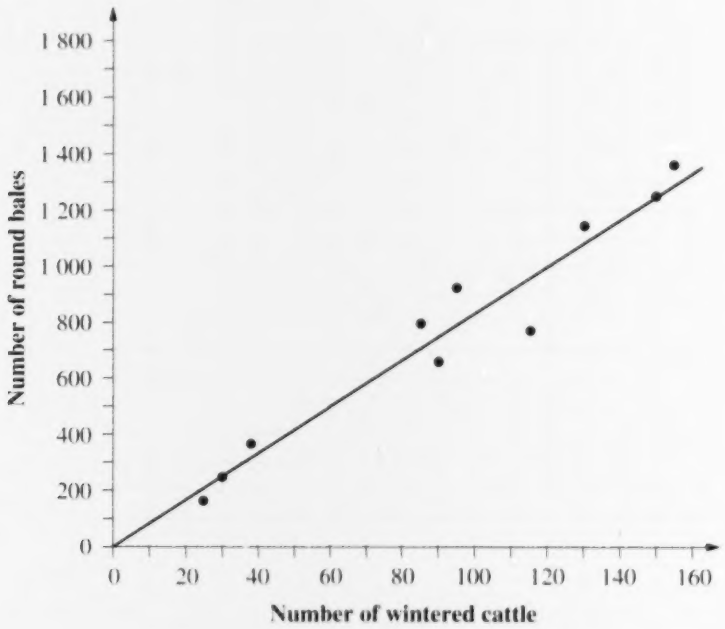
B. 20% and 40%

C. 20% and 50%

D. 25% and 40%

Use the following information to answer the next question.

The Applegates analyzed the number of round bales of hay required to feed their cattle for the winter. They studied the following scatterplot and line of best fit, which relates the number of round bales to the number of wintered cattle.



14. Based on this line of best fit, the number of round bales the Applegates would require to feed 90 wintered cattle is approximately

A. 850

B. 800

C. 750

D. 670

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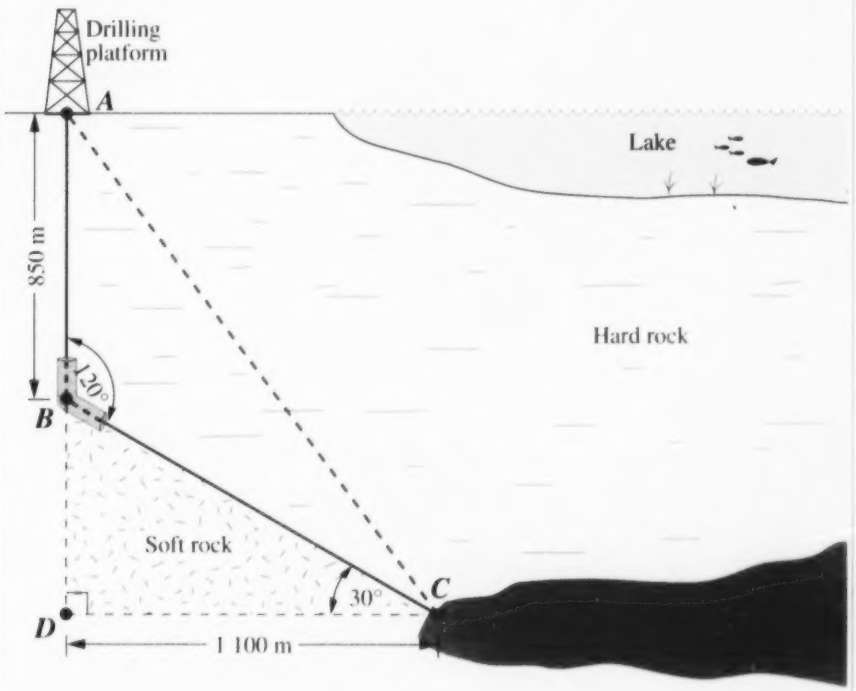
Use the following information to answer the next question.

An oil and gas exploration company wants to drill a test hole to reach an oilfield under a lake on the Applegates' farm. Using the sketch of the site shown below, the company has to decide on one of the following two options.

Option 1 – Drill from A to B, make a $120°$ turn, then drill from B to C. The average cost per metre of this option will be \$860.

or

Option 2 – Drill directly from A to C. The average cost per metre of this option will be \$910.



Written Response — 6 marks

3. **a.** Find the length $\overline{BC}$ to the nearest metre.

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b. Determine the length $\overline{AC}$ to the nearest metre and justify your answer mathematically.

c. Use the **calculated** measures of the two routes, A to B to C, and A to C, to determine the option that will be least expensive.

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Use the following information to answer the next two questions.

The Applegates wanted to save for a trip. They planned to make payments of \$150 each month for 3 years into an annuity that would pay them 6% per annum **compounded monthly**. They began the first four entries of the following table.

Period	Previous balance	Interest at 6% per annum	Payment made	New balance
1	0	0	\$150.00	\$150.00
2	\$150.00	\$0.75	\$150.00	\$300.75
3	—	*i*	—	\$452.25
4	\$452.25	\$2.26	—	*ii*

Numerical Response

6. Rounded to the nearest hundredth of a dollar, the value of *i* is \$_____.

(Record your answer on the answer sheet.)

Numerical Response

7. Rounded to the nearest dollar, the value of *ii* is \$_____.

(Record your answer on the answer sheet.)

CONNECTIONS

Procedures used in simplifying fractions can be connected to procedures used in simplifying rational expressions. Use these procedures, where they apply, to answer the next set of questions, which are related to simplifying rational expressions.

15. An equivalent form of $\frac{5m}{4n} \times \frac{2n^2}{5m}$, where $m \neq 0$ and $n \neq 0$, is

A. $\frac{mn}{2}$

B. $\frac{n}{2}$

C. mn^2

D. $2n$

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16. The simplified form of $\frac{2x+4}{x+3} \times \frac{x^2-9}{x^2+6x+8}$, where $x \neq -3, -2$, or -4, is

A. $\frac{2(x-3)}{x+4}$

B. $\frac{-3}{6x+11}$

C. $\frac{2(x+3)}{x+4}$

D. $\frac{-5}{6x+11}$

Use the following information to answer the next question.

To simplify the rational expression

$$\frac{3x^2+7x-6}{x^2-9} \div \frac{6x-9x^2}{x^2+6x+9}, \text{ where } x \neq -3,\ 0,\ \frac{2}{3},\ \text{or } 3,$$

a student wrote the following steps:

Step I $\frac{3x^2+7x-6}{x^2-9} \times \frac{x^2+6x+9}{-9x^2+6x}$

Step II $\frac{(3x-2)(x+3)}{(x+3)(x-3)} \times \frac{(x+3)(x+3)}{-3x(3x-2)}$

Step III $\frac{\overset{1}{\cancel{(3x-2)}}\overset{1}{\cancel{(x+3)}}}{\underset{1}{\cancel{(x+3)}}(x-3)} \times \frac{\overset{1}{\cancel{(x+3)}}\overset{1}{\cancel{(x+3)}}}{-3x\underset{1}{\cancel{(3x-2)}}}$

Step IV $\frac{1}{-3x(x-3)}$

17. The student made an error in

A. step I

B. step II

C. step III

D. step IV

18. The expression $\frac{2}{x-1} + \frac{3}{x+4}$, where $x \neq 1$ or -4, is equivalent to

A. $\frac{5}{x+3}$

B. $\frac{5}{(x-1)(x+4)}$

C. $\frac{5x+5}{(x-1)(x+4)}$

D. $\frac{5x+3}{(x-1)(x+4)}$

To answer the next set of related questions, remember that the skills and procedures you have learned in simplifying polynomial expressions can be used to simplify radical expressions. Note that for the following three questions, a, b, and c are positive real numbers.

19. Written as a mixed radical, $\sqrt{8c}$ is equivalent to

A. $2\sqrt{4c}$

B. $2\sqrt{2c}$

C. $4\sqrt{2c}$

D. $4\sqrt{c}$

20. An equivalent expression to $a\sqrt{7} + b\sqrt{63} - c\sqrt{28}$ is

A. $2abc\sqrt{7}$

B. $(-6abc)\sqrt{7}$

C. $(a+b-c)\sqrt{42}$

D. $(a+3b-2c)\sqrt{7}$

21. An equivalent form of the radical expression $\frac{2a\sqrt{6}}{\sqrt{8}}$ is

A. $a\sqrt{3}$

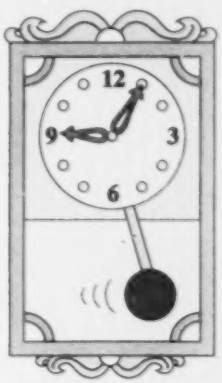
B. $a\sqrt{6}$

C. $2\sqrt{3a}$

D. $\frac{\sqrt{3}}{2a}$

Use the following information to answer the next question.

Some clocks use pendulum motion to measure time. The length of time that it takes for a pendulum to complete one swing (back and forth) depends on the length of the pendulum.



To determine the duration of time for one swing, the formula

$$t = 2\pi\sqrt{\frac{l}{981}},$$

where t is time, in seconds, and l is the length of the pendulum, in centimetres, can be used.

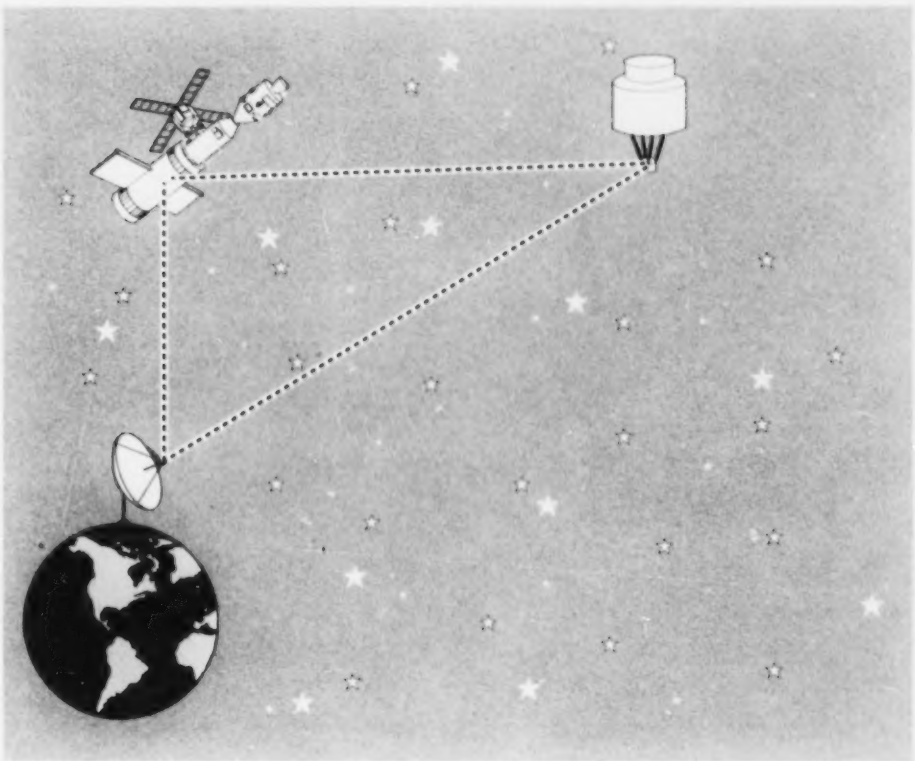
Numerical Response

8. For a pendulum of length 26.0 cm, the time needed to complete one swing, to the nearest hundredth of a second, is _____s.

(Record your answer on the answer sheet.)

AEROSPACE INDUSTRY

Space exploration incorporates many technologies that involve solving mathematical problems. Use your mathematical understanding to answer the next set of questions, which are related to space technologies.



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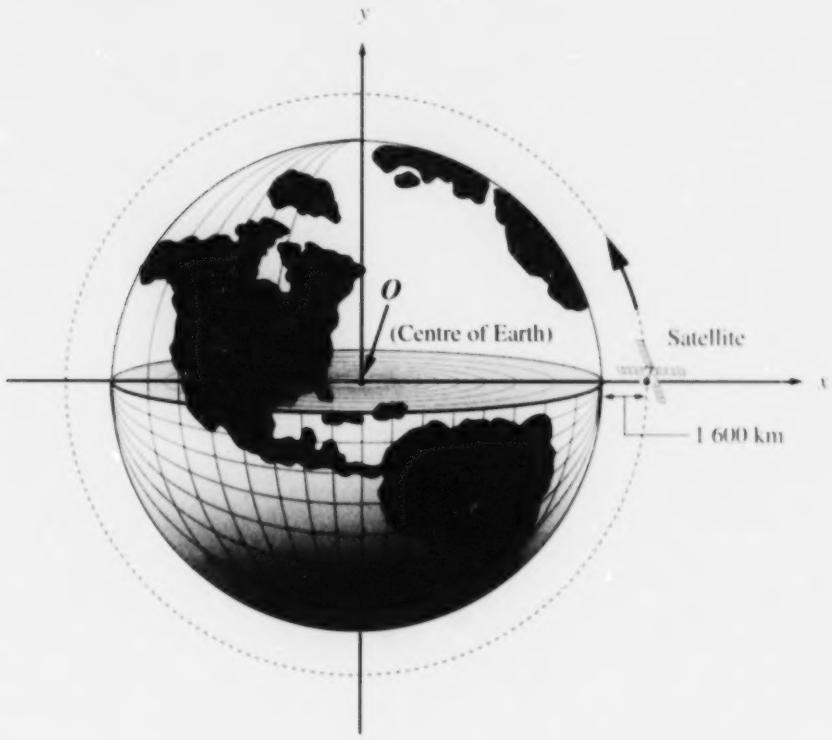
Use the following information to answer the next two questions.

A satellite travelling in a circular orbit 1 600 km above Earth's surface rotates about the centre of the Earth at a constant speed so that it circles Earth every 118 min. In the diagram below, the centre of the Earth is positioned at the origin (O) of the coordinate system of a graph.



22. Given the position of the satellite shown and a rotational angle on the coordinate plane, the length of time required for the satellite to rotate through 270° is

A. 64.9 min

B. 78.7 min

C. 88.5 min

D. 132.8 min

Use the following additional information to answer the next question.

The distances measured from the centre of Earth to a tracking station and from the centre of Earth to the satellite are shown below. The measure of the angle between these two distances is also given.

23. From the tracking station to the satellite, the distance, d, to the nearest kilometre, is

A. 1 835 km

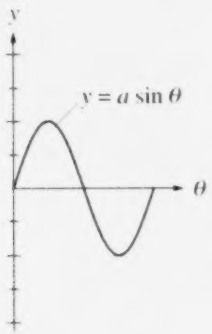
B. 2 205 km

C. 2 294 km

D. 2 555 km

Use the following information to answer the next question.

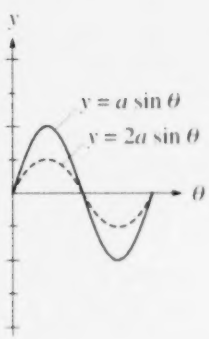
Satellites communicate with Earth using radio waves. Radio waves transmit a signal by changing the amplitude of the wave, $y = a \sin \theta$, as shown in the graph below.



One change occurs when the graph of $y = a \sin \theta$ is transformed to the graph of $y = 2a \sin \theta$.

24. The graphs of $y = 2a \sin \theta$ and $y = a \sin \theta$ are given in figure

A.



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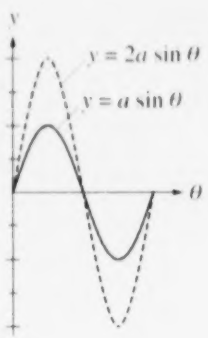
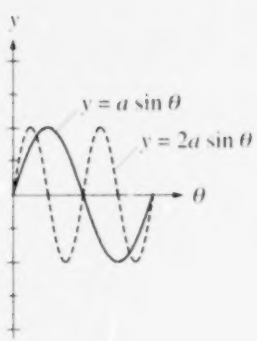
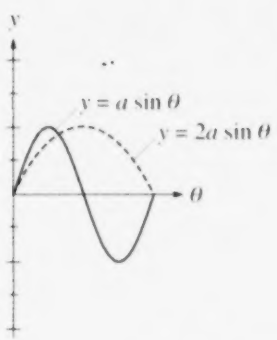


C.

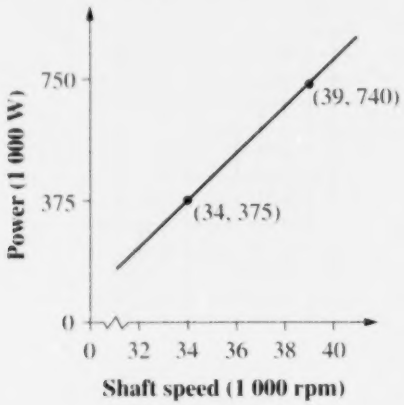


D.



Use the following information to answer the next question.

The shaft speed of a jet engine determines the amount of power generated. The graph below shows the relationship between shaft speed, measured in revolutions per minute (rpm), and power, measured in watts (W).



25. According to the graph, to produce 600 000 W, the number of revolutions per minute (rpm) necessary would be approximately

A. 35 000 rpm

B. 36 000 rpm

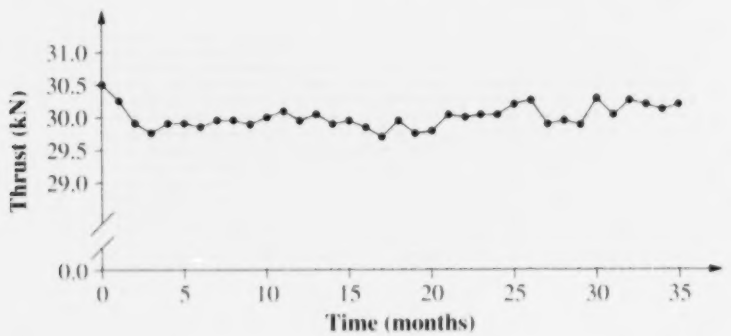
C. 37 000 rpm

D. 38 000 rpm

Use the following information to answer the next question.

Thrust of a Jet Engine

A technician routinely checked the thrust in a jet engine to determine if it needed maintenance. The graph below shows the thrust of a jet engine over time.



Numerical Response

9. According to the graph, the largest thrust measured is _____kN.

(Record your answer on the answer sheet.)

Use the following information to answer the next question.

A space lab technician, working on a 60 volt electric generator, used the quadratic function $P = -5I^2 + 60I$, where P is the power output, in watts, and I is the current, in amperes (A).

26. According to the function, when the power output P is zero, the current is

A. 5 A or 12 A

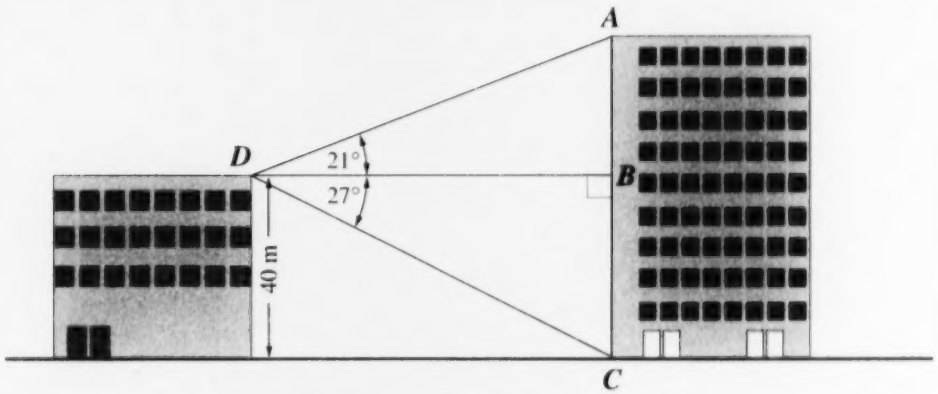
B. –5 A or 60 A

C. 0 A or 12 A

D. 6 A or 180 A

Use the following information to answer the next question.

Two aerospace buildings are to be built near each other and on the same level. From a point D on the top of a 40 m building, the angle of elevation to the top of the taller building will be $21°$, and from the same point D, the angle of depression to the bottom of the taller building will be $27°$, as shown below.



27. The height $\overline{AC}$ of the taller building, to the nearest metre, will be

A. 40 m

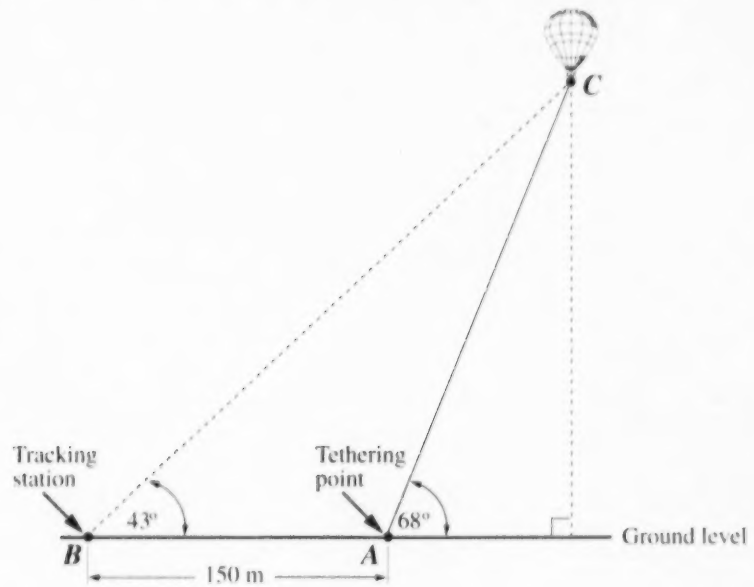
B. 60 m

C. 70 m

D. 79 m

Use the following information to answer the next question.

A weather balloon tethered to the ground 150 m from an areospace tracking station is floating so that its cable makes an angle of 68° with the ground at the tethering point A. The angle of elevation from the tracking station at point B to the balloon is 43°, as shown below.



28. To the nearest metre, the length of the cable $\overline{AC}$ is

A. 110 m

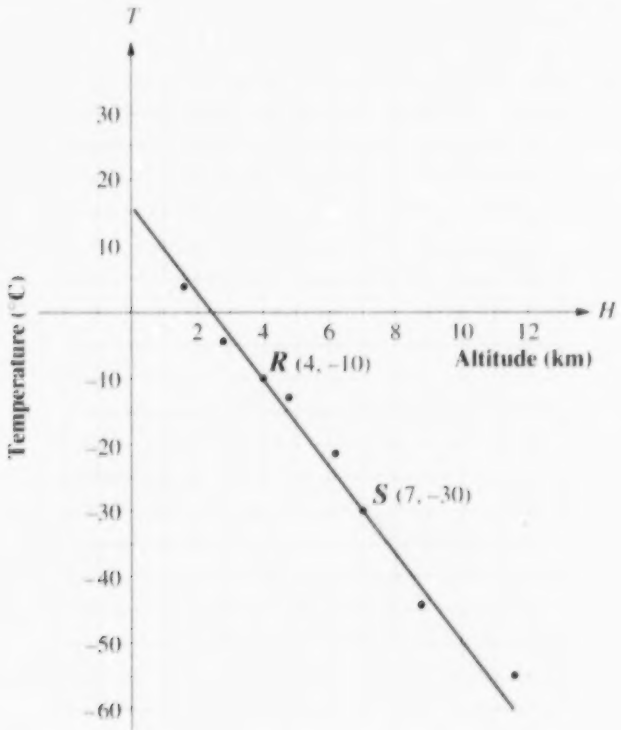
B. 140 m

C. 204 m

D. 242 m

Use the following information to answer the next question.

Data from a satellite were used to construct the following scatter plot, which relates the altitude above Earth's surface to air temperature. A line of best fit has been included.



29. Given the points R and S, the equation for the line of best fit is

A. $T = -\frac{20}{3}H + \frac{50}{3}$

B. $T = -\frac{3}{20}H - \frac{47}{5}$

C. $T = -\frac{1}{150}H + \frac{50}{3}$

D. $T = -\frac{1}{150}H - \frac{110}{3}$

Trigonometry is used in the aerospace industry to connect understandings of algebra and geometry to drawings of angles on coordinate planes.

30. A technician drew a diagram of a terminal arm on a coordinate plane. The initial arm is in standard position. The terminal arm passed through the point $(-2, 5)$. The cosine of the angle formed is

A. $\frac{-2}{\sqrt{29}}$

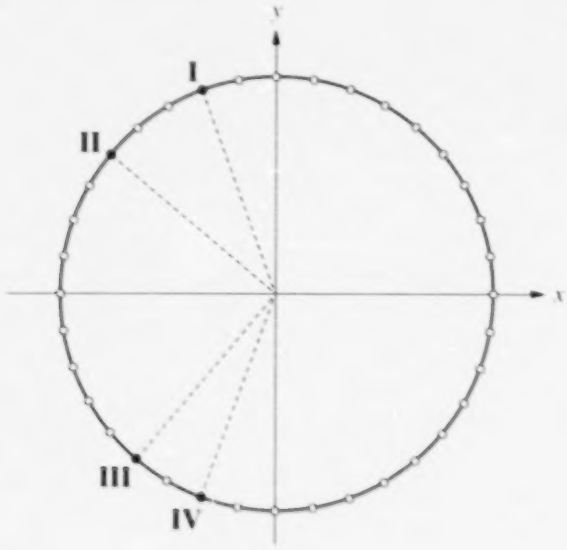
B. $-\frac{5}{\sqrt{29}}$

C. $-\frac{2}{5}$

D. $-\frac{5}{2}$

Use the following information to answer the next question.

A technician needs to balance a circular jet engine part by placing a weight at a position that has a reference angle of $40°$ in the second quadrant. His computer generates the following display.



31. Given a reference angle of $40°$, the balancing weight should be placed in position

A. I

B. II

C. III

D. IV

Use the following information to answer the next question.

A jet engine is built to withstand the impact of a collision with a bird. To avoid engine damage, the kinetic energy (KE) of the impact must be less than 8 600 J. The kinetic energy produced by a collision with a bird can be estimated by the equation

$$KE = \frac{1}{2}mv^2,$$

where m is the mass of the bird, in kilograms, and v is the airspeed of the aircraft, in metres per second.

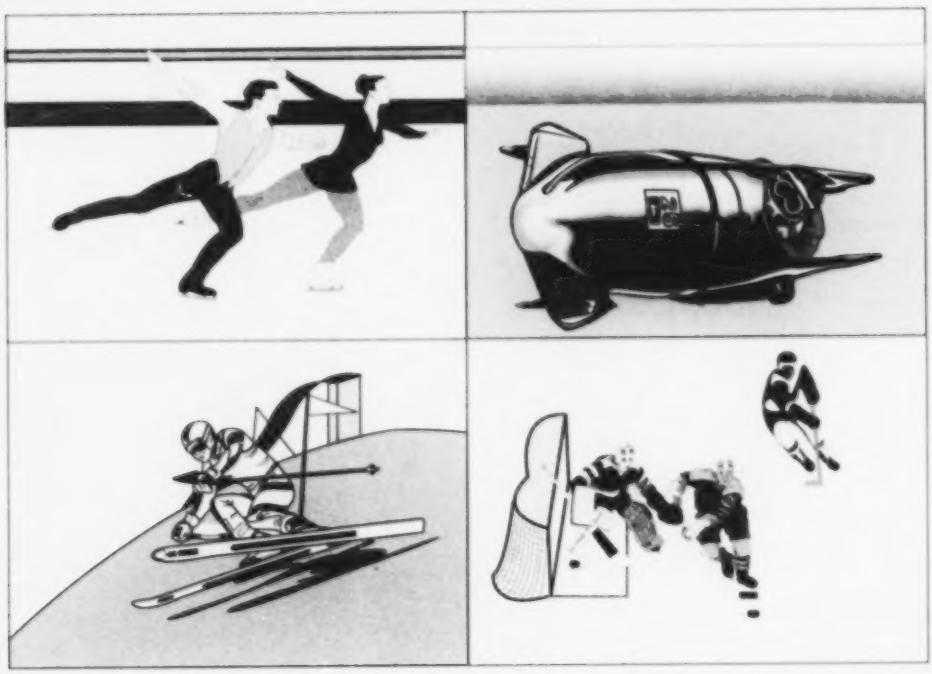
Numerical Response

10. If the airspeed of an aircraft is 88 m/s, then the mass of a bird, to the nearest hundredth kilogram, that the aircraft engine could collide with and not sustain damage must be less than _____ kg.

(Record your answer on the answer sheet.)

SPORTS AND RECREATION

Calgary was the site of the 1988 Winter Olympics. The next set of questions requires you to link your mathematical understanding to the operations of Olympic sites and events.



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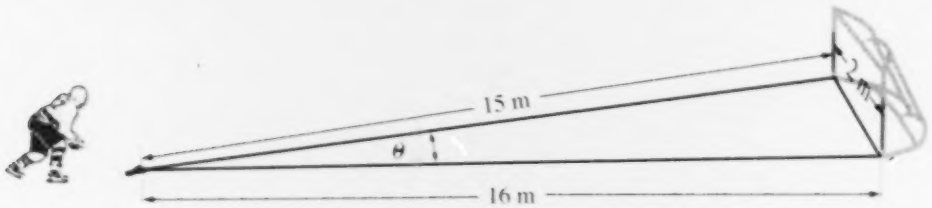
Use the following information to answer the next question.

An Olympic coach used the following diagram to explain the angle within which players should shoot. The net is 2 m wide and the puck is 16 m from one post and 15 m from the other post.



32. In order for the puck to hit the net from the position shown, the player must shoot it within angle θ. The measure of angle θ, to the nearest tenth of a degree, is

A. 4.0°

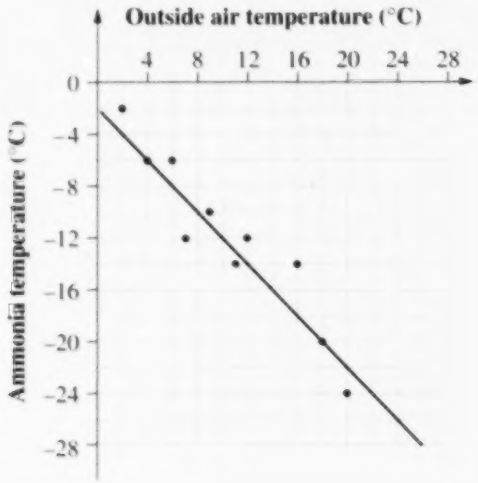
B. 6.4°

C. 7.2°

D. 8.0°

Use the following information to answer the next question.

To maintain the temperature of the ice on a bobsled course at 0°C, ammonia is pumped through tubes below its surface whenever the air temperature rises above 0°C. The scatter plot below portrays the relationship of the air temperature (°C) to the temperature of ammonia (°C) required to maintain the ice temperature at 0°C.



33. The apparent correlation between the outside air temperature and the ammonia temperature is

A. zero

B. positive

C. negative

D. undefined

Use the following information to answer the next question.

The finishing times separating teams at bobsled races are often extremely close. During a 1 300 m race, the difference between the first-place team and the second-place team was only 0.12 s in time and 0.1 m/s in average speed. To calculate the time it took the slower bobsled team to cover the course, x, the equation below can be used.

$$\frac{1\,300}{x-0.12}-\frac{1\,300}{x}=0.1$$

34. The non-permissible values for x in this rational equation are

A. 0.1 and 0.12

B. 0 and 0.12

C. 0 and 0.1

D. 0, 0.1, and 0.12

Use the following information to answer the next question.

On a particular ski slope, the path of the snow thrown from a snowmaking machine is described by the function $f(x)=-(x-6)^2+l$, where $f(x)$ is the vertical distance, in metres, and x is the horizontal distance, in metres, that the snow is thrown from the machine. After adding a bacterial additive, the path of the snow is changed and the new function that describes its path is $g(x)=-(x-3)^2+(l-11)$.

35. The graphs of the two functions open downward because the completed square form, $y=a(x-h)^2+k$, of each of the two quadratic functions has a parameter of

A. $a=-1$

B. $d=-3$

C. $h=3$

D. $h=-6$

Use the following information to answer the next question.

A sports reporter used statistics and a data booklet containing 90% box plots from sample sizes of 20, 40, 80, and 100 to draw inferences about the number of Olympians qualifying for an event. From a random sample of Olympians trying out for the event, the reporter determined that 60% qualified. The reporter wrote "Based on this sample, the 90% confidence interval for the percentage of Olympians who qualified out of those trying out for this event is between 40% and 75%."

Numerical Response

11. Given the statement the reporter wrote, the sample size surveyed must have been _____.

(Record your answer on the answer sheet.)

Use the following information to answer the next question.

The path of an aerial skier's reverse somersault can be illustrated by the graph of the function $h = -5(t - 1)^2 + 8$, where h is the height, in metres, above the ground and t is the time, in seconds, after the skier leaves the hill.

36. According to this function and its related graph, which plots the skier's height above the ground at various times, the vertex of the graph and the maximum height that the skier reaches, respectively, are

A. (–1, 8) and 1 m

B. (1, 8) and 1 m

C. (1, 8) and 8 m

D. (–1, 8) and 8 m

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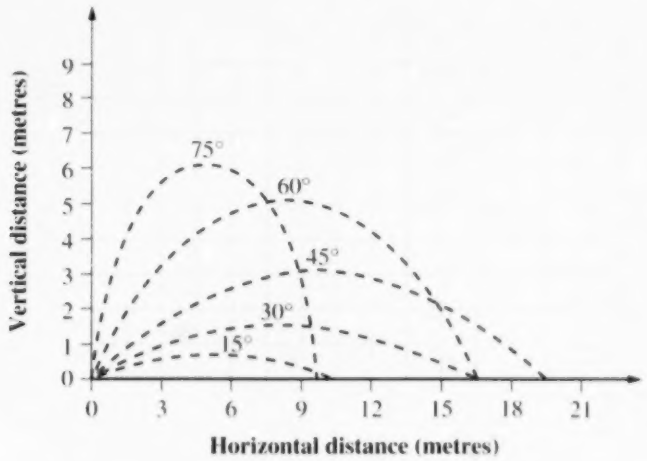
Use the following information to answer the next question.

Aerial skiers know that the horizontal and vertical distances they attain will depend on the angle of trajectory they have when they leave the ground. The graphs below represent the paths of an aerial skier at five different angles of trajectory.



Written Response — 5 marks

4. **a.** With which of the five trajectories would the skier attain the maximum horizontal distance? Be sure to identify the corresponding angle.

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b. In order to have sufficient time to perform a stunt, an aerial skier wants to attain as much height as possible. Identify which of the five graphs given represents the greatest maximum height that the skier could attain. Support your answer.

c. Compare vertical and horizontal distances for a skier who is moving at a 60° angle with those of a skier who is moving at a 45° angle. Support your answer with evidence from the graphs provided.

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Use the following information to answer the next question.

During a performance, a figure skater jumps into the air and makes four complete rotations in midair.

37. The number of degrees the skater would rotate through in midair is

A. 1 440°

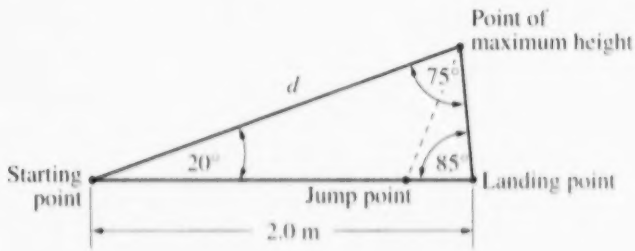
B. 1 080°

C. 720°

D. 360°

Use the following information to answer the next question.

A figure skater's coach planned a jump using an oblique triangle in a vertical plane, as shown below.



Numerical Response

12. The straight-line distance d from the starting point to the point of maximum height, to the nearest hundredth metre, is _____ m.

(Record your answer on the answer sheet.)

30

No marks will be given for work done on this page.

Fold and tear along perforation.

Tear out
Page

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Mathematics 33
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